Chapter 4
FLOOD PROTECTION AND FLOODPLAIN MANAGEMENT

GOALS

The *State Comprehensive Plan*, Chapter 187, F.S., includes flood protection and floodplain management goals as follows:

- Require local governments, in cooperation with regional and state agencies, to adopt plans and policies to protect public and private property and human lives from the effects of natural disasters (Section 187.201(7)(b)25, F.S.)
- Encourage the development of a strict floodplain management program by state and local governments designed to preserve hydrologically significant wetlands and other natural floodplain features (Section 187.201(8)(b)8, F.S.)

In order to achieve these goals the District has identified the following goals for flood protection and floodplain management:

- Protect from and mitigate for the impacts of flood events
- Protect and restore natural features of floodplains

RESOURCE ASSESSMENT

Flood Protection

Without flood protection, most of South Florida would be unsuitable for existing urban and agricultural development. To the extent possible, the District provides regional flood protection through operation of the works of the Central and Southern Florida (C&SF) Project, as well as projects within the Big Cypress Basin. In accordance with state policies, these facilities are operated following the regulation schedules and operational guidelines established by the U.S. Army Corps of Engineers (USACE).

Flood protection in South Florida is achieved by a combination of regional and local drainage systems. The District's responsibilities for flood protection facilities relate to serving regional (primary) water conveyance and storage needs. The SFWMD plans, constructs, operates, and maintains regional water control facilities and regulates the discharges into that regional system. Subregional (secondary) and local (tertiary) drainage systems are operated by a variety of special districts, private property owners, and local governments, which operate under District permit. The local systems typically convey water from individual projects to the regional systems operated by the SFWMD.

Local governments have the primary responsibility for regulating land use. Local governments also enforce construction criteria for flood prone areas, establish local storm water management levels of service, construct and maintain local flood control facilities, and otherwise prevent flood damage to new and existing development. The SFWMD encourages local governments to recognize the limitations of the existing local and regional systems and to anticipate and plan for the impacts of proposed new development in their comprehensive plans.

Some areas of the District depend entirely on natural surface water systems, such as rivers, streams, sloughs, and wetlands, for flood protection. The water levels in many of these systems fluctuate in response to seasonal variations in rainfall. Land development and encroachment onto floodplains have increased the rate and volume of runoff and have reduced the area available for water storage. This has resulted in flooding and erosion in some areas. In order to minimize these impacts, the SFWMD works with local governments to preserve natural water management systems and to protect existing and future development from flooding.

National Flood Insurance Program Claims and Repetitive Losses

In spite of local, subregional, and regional efforts, the flat topography and intense land uses of South Florida, in combination with intense rainfall events, have resulted in periodic flooding. The pattern of the impacts on residents of these flooding events can be seen in **Figure 23,** which shows flood loss claims made within the National Flood Insurance Program (NFIP) and repetitive loss data from the Federal Emergency Management Agency (FEMA) between 1978 and 1998.

The C&SF Project

A central element of the C&SF Project is Lake Okeechobee, which has a surface area of 730 square miles and a maximum storage capacity of 1.05 trillion gallons (SFWMD, 1997b). Lake Okeechobee's regulation schedule is intended to provide flood protection benefits (in addition to benefits for the District's other areas of responsibility), so lower water levels are maintained in the summer wet season. In addition to the canal network and the corresponding structures (spillways, culverts, weirs, and pump stations) required to operate it, the C&SF Project includes the three Water Conservation Areas (WCAs). The WCAs divide the former Everglades into areas designated for development and areas set aside for water storage, natural system preservation, and fish and wildlife benefits.

The C&SF Project was designed following the 1947 flood, and the majority of its structures were built in the 1950s and early 1960s. The system design was based on the effects of a design storm on projected land use. A design storm for a basin is the most severe rainfall event for which the basin canals, structures, and/or lakes were designed to handle the runoff, without flooding occurring in the basin. The projected land uses the system was designed for were primarily agricultural. In many watersheds, actual land uses are presently more urban and more intensive than the projections used in the project's design, often resulting in the generation of more runoff than was originally projected.

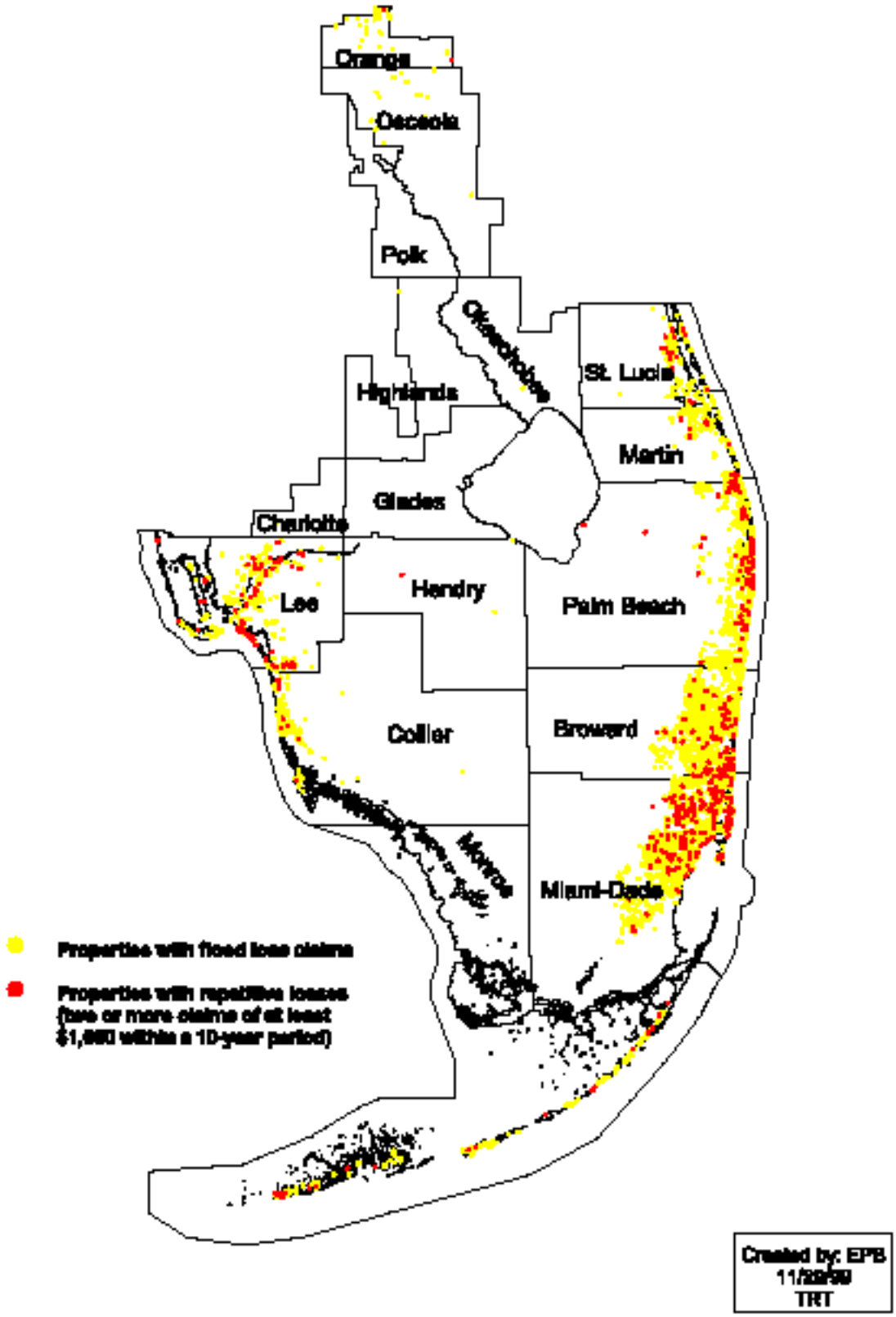

Figure 23. National Flood Insurance Claims and Repetitive Losses 1978 to 1998.

When the C&SF Project was designed, its primary function was flood protection, although there were additional benefits to water supply, fish and wildlife preservation, and other functions. Since the construction of the C&SF Project, the District's responsibilities have expanded to emphasize other aspects of water resource management. The operational goals of the system have become broader and more complex than the system was originally designed to meet, and this has pushed the C&SF Project beyond its original design objectives, and has revealed its limitations as a multifunctional system.

The SFWMD continues to operate and maintain the C&SF Project, which includes the primary drainage system of the Lower East Coast (LEC), the Upper East Coast (UEC), and the Kissimmee Basin. Major features of the project are shown in **Figure 24** and in detail on the Structure and Canal Locations map inserted in this document's front cover. The SFWMD operates and maintains the C&SF Project to accomplish the following objectives:

- Ensure the reliability and integrity of the system, through routine inspection, maintenance, and replacement of system components (i.e., water control structures, levees, canals)
- Optimize flood protection, water supply, and natural system benefits
- Improve the SFWMD's operational ability to anticipate and respond to the water resource management demands on the system, using the best available science and technology

In recent years, the District installed a microwave communications system that allows real time data collection and remote control of distant gate structures. This capability, together with expanded weather monitoring and forecasting activities, enhances operational effectiveness. The District's structural improvement and replacement projects are included in the Five-Year Capital Improvements Plans that are produced annually.

Canal Conveyance Capacity Program

The SFWMD has an ongoing Canal Conveyance Capacity (CCC) Program to evaluate the maintenance, dredging, and bank stabilization requirements of the C&SF Project. The primary objectives of this program are as follows:

- Continue a systematic approach to inspect SFWMD canals to determine the need for maintenance dredging
- Inspect all canals over a five-year period
- Establish standard canal survey criteria
- Develop detailed engineering plans and specifications to implement restoration of conveyance on each canal

The CCC Program is the single largest activity of the capital refurbishment effort. This program is intended to restore the original design capacity of the canals as constructed by the USACE. The CCC requires significant funding and resources and will

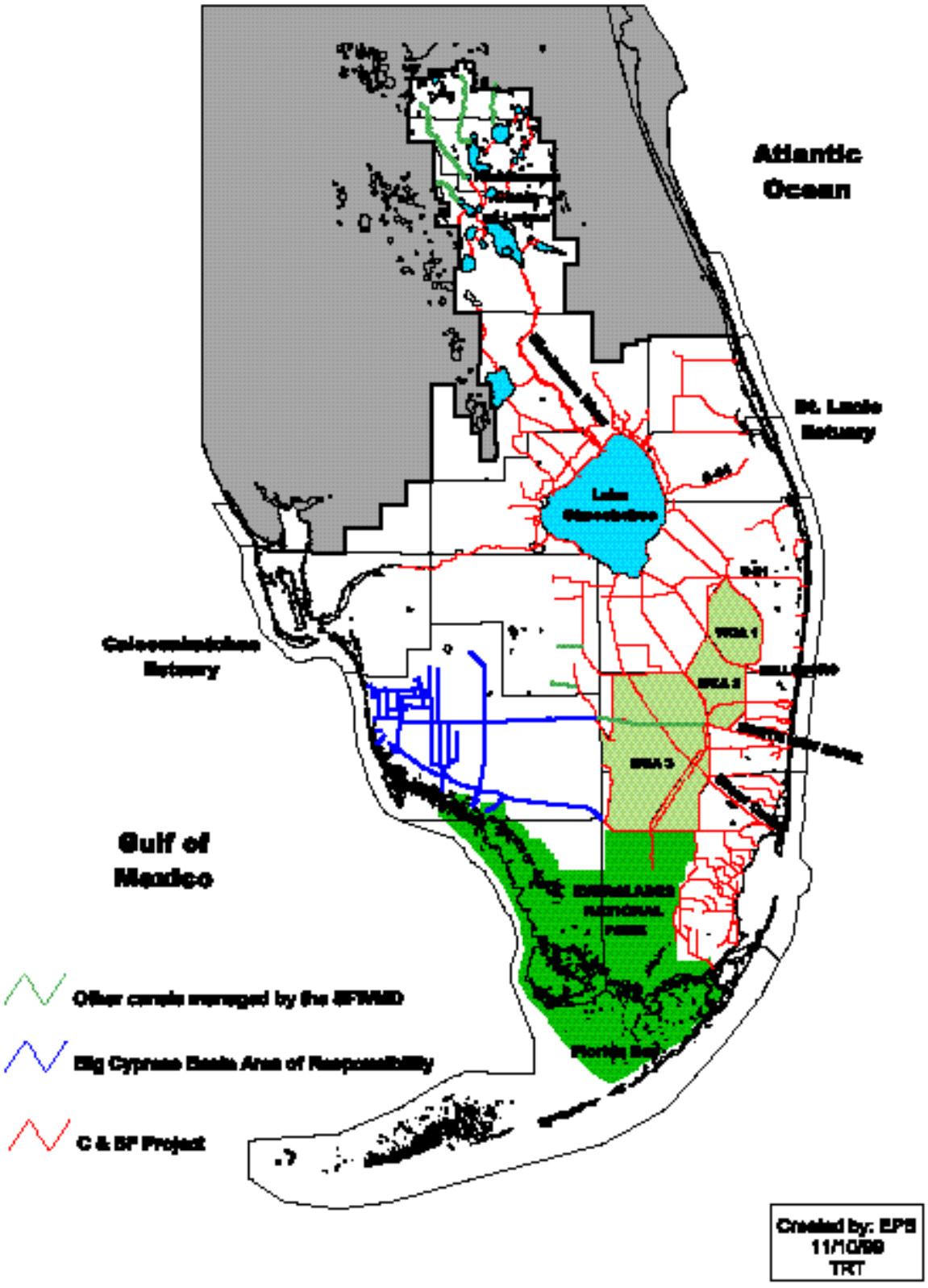

Figure 24. Surface Water Management System Managed by the SFWMD.

extend over a period of several years. The CCC program is a multidisciplinary initiative which allows the District to develop a system to establish the priority of canal maintenance projects considering a variety of factors, including service area, original design criteria, recorded flood problems, operational constraints, and shoal and stabilization problems.

C&SF Project Maintenance

The C&SF Project consists of 292 primary water control structures, 27 pump stations, 1,800 miles of canals, and 2,000 secondary structures. The C&SF Project is operated and maintained by the SFWMD. The components of the C&SF Project typically range in age from 30 to 50 years. Due to the age of this infrastructure, the SFWMD annually allocates significant funds for the maintenance necessary to provide flood control and water supply readiness. These funds are allocated in the form of individual projects that target major components of the C&SF Project. The principal components of the C&SF Project are improvements and upgrades through automation; pump station repair and restoration; gravity structure repair and restoration; levee repair; and canal conveyance dredging. These funds are not used for capital expansion. Typically, elements of large restoration projects such as the Everglades Construction Project (ECP) and Kissimmee River Restoration are addressed as separately funded programs.

The District has developed and implemented an effective maintenance program that is continuously evaluated and upgraded. This program has allowed the original components of the C&SF Project to remain in operation. However, many of the components have met, or are nearing the end of, their design life cycle. Examples include electrical systems and engines of the pump stations, secondary inflow culverts (project culverts) that were installed nearly 40 years ago, and the canals themselves that have accumulated sediment over the past 40 to 50 years.

The Restudy and the Comprehensive Everglades Restoration Plan

The C&SF Project Comprehensive Review Study (Restudy) was a five-year study effort that looked at modifying the current C&SF Project to restore the greater Everglades and South Florida ecosystem while providing for the other water related needs of the region. The study concluded with the *Central and Southern Florida Flood Control Project Comprehensive Review Study Final Integrated Feasibility Report and Programmatic Environmental Impact Statement* (USACE and SFWMD, 1999) being presented to Congress on July 1, 1999. The recommendations made within the Restudy (i.e., structural and operational modifications to the C&SF Project, are being further refined and will be implemented in the Comprehensive Everglades Restoration Plan (CERP). The Restudy and CERP are further described in **Chapter 1**.

The Big Cypress Basin System

The SFWMD, through its Big Cypress Basin Board, operates and maintains the Big Cypress Basin system in Collier County. This system includes 163 miles of canals and 40 water control structures. Land developers constructed most of these facilities to provide

drainage for urban or agricultural development. During the last two decades the Big Cypress Basin added several water control structures and modified many canal segments to enhance their flood conveyance and water conservation functions.

Big Cypress Basin's 1997-2001 five-year plan includes development of a basinwide water management plan. Much of the proposed effort focused on structure modification to remedy overdrainage problems and to address the needs and constraints of flood protection, water supply, natural systems, and water quality. The recently completed flood control element of the plan assessed that 47 miles of the basin's 163 miles of primary canals (29 percent) cannot provide the intended level of service for flood protection. The plan recommended a combination of five-segment capital improvements for the urban portion of Golden Gate Main, Henderson Creek, and CR 951 canals consisting of channel modification, flow diversion, structural retrofit, and ASR of wet season peak flows. These elements will be incorporated into the Big Cypress Basin Board's Five-Year Capital Improvement Program. The District will continue to pursue options to reduce overdrainage and saltwater intrusion caused by the system, while maintaining flood protection to existing development.

Floodplain Management

Flood protection overlaps with the overall floodplain management strategy. Floodplains are level land that may be submerged by flood waters. The water management districts have agreed that, for mapping purposes, floodplains should include "land area that may be submerged by floodwaters from a river, lake or coastal waters; but should not include isolated low lying areas which may be inundated due to a lack of drainage" (FDEP et al., 1994). The water management districts and the Florida Department of Environmental Protection (FDEP) have specifically stated that the definitions and practices established for designation of these areas are more applicable to areas with natural riverine flows than to areas with highly controlled water management systems. Much of South Florida has a highly controlled water management system, rather than the natural riverine flows that characterize other areas of the state.

At a minimum, each water management district is required to determine the 100-year flood levels for its priority floodplains. Because of the managed nature of the surface water system in South Florida, few areas of riverine flooding problems occur in the region. Therefore, floodplain mapping has not been a priority of the District.

Flooding in South Florida usually results from slow runoff and infiltration, which is due to the region's flat topography and soils that become saturated after extensive rains. The problems may affect extensive areas within a basin and are not necessarily confined to areas immediately adjacent to defined water courses. Existing development within a basin can result in increased runoff, which can lead to increased flood conditions within the basin or in other downstream basins. State Water Policy (Section 62-40.310, F.A.C.) encourages the utilization, preservation, restoration, and enhancement of natural water management systems and discourages the channelization or other alteration of natural rivers, streams, and lakes. The state seeks to protect the water storage and water quality

enhancement functions of wetlands and floodplains through acquisition, law enforcement, and the implementation of compatible land and water management practices. The state also must manage floodplains and other flood hazard areas to prevent or reduce flood damage.

The District's floodplain management efforts include planning and regulation. Conceptual plans are developed for each project area. Operational plans are created for only those management activities that require a technically detailed plan. Both operational and conceptual plan content is standardized in a logical sequence to ensure comprehensive coverage of pertinent issues and information. The purpose of conceptual management planning is to produce a guideline document that will direct the land manager toward realizing the land management goals on a specified management project area. Conceptual plans define goals and objectives, identify and prioritize major management needs and issues, serve as a management assessment, and are expandable to adjust for the discussion of future significant management requirements.

The SFWMD will also continue to protect floodplains through the Environmental Resource Permitting (ERP) Program. This will include active coordination with local governments, special districts, appropriate federal agencies, the Florida Department of Community Affairs, and the Florida Department of Health and Rehabilitative Services.

ISSUES

The SFWMD has, since its inception, mitigated the region's high vulnerability to flooding. This has been done through structural and nonstructural means. Structural methods include the construction and management of canals, levees, dikes, dams, pump stations, reservoirs, and other water control structures. Nonstructural approaches have included the acquisition of flood prone areas and appropriate floodplain management. The main issues that face the District, with regard to flood protection and floodplain management, are as follows:

Issue 1. The protection of public health, safety, and welfare from the impacts of flooding

Issue 2. The water supply, water quality, and environmental consequences of protecting land uses from flooding

Issue 3. Reconciling conflicting flood protection goals of different land uses (e.g., agriculture, residential, ecosystem restoration)

Objectives, Strategies, and Performance Measures

Core Objective FP 1: Minimize damage from flooding

The SFWMD has developed strategies to meet this core objective. The strategies will be implemented via budgeted activities in the categories of Planning, Public Works Construction, Operations and Maintenance, Regulation, Outreach, and Monitoring and Evaluation (**Table 11**).

Performance Measures for Objective FP 1

- **Core FP 1(a):** Percentage of District works maintained on schedule
- **SFWMD FP 1(b):** Number and cost of storm water retrofit projects carried out by the District
- **SFWMD FP 1(c):** Average number of days to complete ERP permit review and issue a permit once the application is complete
- **SFWMD FP 1(d):** Number of permit applications received
- **SFWMD FP 1(e):** Number of preapplication inspections
- **SFWMD FP 1(f):** Number of permits issued

Table 11. Activities Table for Core Objective FP 1.

FY2001 Budget Activity Code	Strategies	Description	Year Complete	Responsible Entity
Core Objective FP 1: Minimize damage from flooding				
		Planning		
Nf02	Big Cypress Basin Watershed Project	The Big Cypress Basin Watershed Project includes the generation of digital topographic information, the development of a calibrated hydrologic model for the Big Cypress Basin, and the incorporation and engineering, economic, and environmental analyses of alternative water management strategies into a recommended watershed management plan for the Big Cypress Basin.	2000	SFWMD
Jg02	South Lee County Watershed Plan	Severe flooding in 1995 raised the issue of water flows in southern Lee County. The South Lee County Watershed Plan addresses this issue. The work in this project will involve three phases. During Phase I, the necessary background data will be obtained and hydrologic and hydraulic models of the study area will be developed. During Phase II, the ecological value of the study area will be assessed and the target hydrologic parameters for restored conditions will be identified. During Phase III, models will be applied to evaluate the performance of existing water management facilities in the study area, existing problems will be identified, and alternative facilities and systems will be developed and assessed.	2003	SFWMD

Table 11. Activities Table for Core Objective FP 1. (Continued)

FY2001 Budget Activity Code	Strategies	Description	Year Complete	Responsible Entity
Public Works Construction				
Ca	Capital Program	Capital Program activities include capital improvements, modifications, or repairs to District water control and conveyance facilities.	Ongoing	SFWMD
Ei	Modified Water Delivery Project	The Modified Water Deliveries Project is designed to restore the hydrologic balance between western Shark River Slough and northeastern Shark River Slough, to benefit Everglades National Park flora and fauna.	2003	SFWMD
Eh	C-111 Project Implementation	The C-111 Project consists of both structural and nonstructural modifications to the existing works within the C-111 Basin to promote more natural hydroperiods in Taylor Slough and the eastern panhandle ecosystems of Everglades National Park. Flood protection within the C-111 Basin east of the L-31N and C-111 canals will be maintained.	2004	SFWMD
Fb02	Kissimmee Basin Flood Control and Protection	This activity primarily provides for the construction of facilities for the flood mitigation efforts associated with the implementation of the Kissimmee River Restoration Project. Pool D residential flood proofing construction is scheduled for completion in 2002.	Ongoing	SFWMD
Operations and Maintenance				
Ce	Structure Operations	Structure operations include the movement of water, pumping operations activities, and automation for the C&SF Project canal system.	Ongoing	SFWMD
Cf	Water Control Structure Maintenance	Water control structure maintenance includes District pump stations, structures, project culverts, and special construction projects.	Ongoing	SFWMD
Cg	Canal/Levee Maintenance	Canals and levees must be maintained. Maintenance includes replacement of project culverts, bank stabilization, revegetation, mowing, tree removal, and shoal removal.	Ongoing	SFWMD
Ci	Equipment Maintenance	Equipment maintenance consists of preventive and cyclic maintenance and restoration of a variety of equipment for the regional flood control systems.	Ongoing	SFWMD
Cj	Electronics, Communications, and Control Devices	District communication, electronics, and control devices must be developed, installed, supported, and maintained. These include Supervisory Control and Data Acquisition (SCADA) system devices, microwave system devices, and District radio communication components.	Ongoing	SFWMD
Ck	Exotic Plant Control	Invasive exotic aquatic and terrestrial vegetation within District canals, canal banks, lakes, rights-of-way, and preserve lands must be controlled. This control is accomplished through in-house and contracted herbicidal, mechanical, and biological control methods. This program works primarily to ensure conveyance capacity within canals and water bodies.	Ongoing	SFWMD
Cl	Right-of-Way Management	Right-of-Way Management involves the management of uses of District rights-of-way by means of permitting and enforcement initiatives designed to minimize outside impacts on the District's ability to operate and maintain the canal and levee system.	Ongoing	SFWMD

Table 11. Activities Table for Core Objective FP 1. (Continued)

FY2001 Budget Activity Code	Strategies	Description	Year Complete	Responsible Entity
M	Emergency Management	The mission of the District's Emergency Management Program is to prevent or minimize, prepare for, respond to, and recover from emergencies or disasters that threaten life or property within the boundaries of the District. These activities ensure that the District can accomplish its mission during adverse conditions. The District also works closely with, and offers support to, local and state emergency managers to prepare for and assist with man-made hazards, dam failures, nuclear power plant failures, fires, storms, and a number of other types of emergencies within Florida.	As needed	SFWMD
Regulation				
Ha	Environmental Resource Permitting (ERP)	ERP involves the technical review and evaluation of construction plans for proposed development activities, recommendations for project design changes to ensure proposed activities meet District criteria, negotiation with permit applicants, field inspections of project sites requesting permits or wetland determinations, compliance review of project sites to ensure compliance with permit requirements, compliance review of submitted documents required by permit special conditions, preparation of technical staff reports, and preparation of requests for additional information.	Ongoing	SFWMD
Outreach				
Ga01	Local Government Comprehensive Plans	Comprehensive plans and amendments are reviewed by the District as required by Chapters 163 and 298, F.S. This activity is being significantly cut back for FY2001 to provide funding for CERP.	Ongoing	SFWMD
Monitoring and Evaluation				
Fe03	Flood Control Level of Service	As an outcome of the Hurricane Irene action report, a full analysis of the current flood protection level of service for the entire geographic region of the Kissimmee Basin is being conducted. The flood protection level of service has been conducted as part of the Kissimmee River Restoration Project. This initiative will be conducted for the northern portion of basin.	Ongoing	SFWMD
Jm02	Basin Flood Studies	This consists of basin flood studies in the C-17 and C-51 basins. The C-17 Basin Study will investigate increasing flood mitigation and conveyance capacity of the C-17 Canal and the S-44 Structure without adversely affecting the receiving water body (Lake Worth Lagoon). The C-51 Basin Study will reevaluate the C-51 Basin Rule (surface water management permitting criteria).	Ongoing	SFWMD

Core Objective FP 2: Promote nonstructural approaches to achieve flood protection, and to protect and restore the natural features and functions of the 100-year floodplain

The SFWMD has developed strategies to meet this core objective. The strategies will be implemented via budgeted activities in the categories of Land Acquisition and Regulation (**Table 12**).

Performance Measures for Objective FP 2:

- **Core FP 2(a):** Number of acres identified for acquisition to minimize damage from flooding and the percentage of those acres acquired

Table 12. Activities Table for Core Objective FP 2 .

FY2001 Budget Activity Code	Strategies	Description	Year Complete	Responsible Entity
Core Objective FP 2: Promote nonstructural approaches to achieve flood protection, and to protect and restore the natural features and functions of the 100-year floodplain				
		Land Acquisition		
Ab	Stewardship Save Our River (SOR) Lands	SOR Stewardship activities include plan and implement a stewardship work plan, administer a land acquisition plan, administer a public use rule, and administer mitigation banks/ projects.	Ongoing	SFWMD
Za	General Land Acquisition	This activity involves land acquisition for the SOR Program. The SOR Act enables the water management districts to acquire lands necessary for water management, water supply, and the conservation and protection of water resources.	Ongoing	SFWMD
		Regulation		
Ha	Environmental Resource Permitting (ERP)	ERP involves the technical review and evaluation of construction plans for proposed development activities, recommendations for project design changes to ensure proposed activities meet District criteria, negotiation with permit applicants, field inspections of project sites, requesting permits or wetland determinations, compliance review of project sites to ensure compliance with permit requirements, compliance review of submitted documents required by permit special conditions, preparation of technical staff reports, and preparation of requests for additional information.	Ongoing	SFWMD